

# Mobile Payments Go Viral

## M-PESA in Kenya

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**M**-PESA is a small-value electronic payment and store-of-value system in Kenya accessible from ordinary mobile phones. It has seen exceptional growth since its introduction in March 2007. Now in use by 9 million customers—40 percent of Kenya's adult population—the system processes more transactions domestically than Western Union does globally. M-PESA's market success is the result of the interplay of three factors: preexisting country conditions that made Kenya a conducive environment for a successful mobile money deployment; a clever service design that facilitated rapid adoption and early capturing of network effects; and a business execution strategy that helped M-PESA rapidly reach a critical mass of customers, thereby avoiding the adverse chicken-and-egg (two-sided market) problems that afflict new payment systems.

### M-PESA IN A NUTSHELL

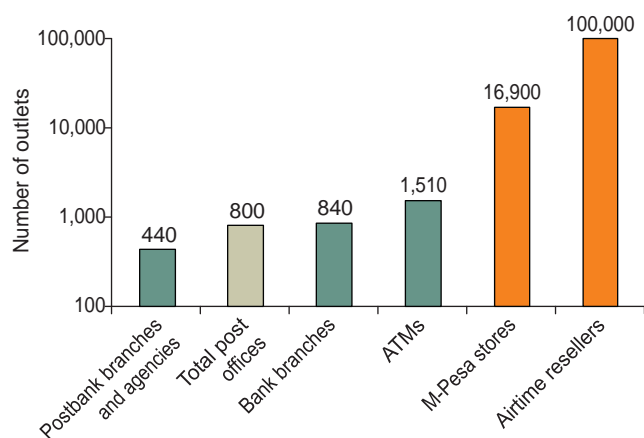
M-PESA (“M” for mobile and “PESA” for money in Swahili) was developed by mobile phone operator Vodafone and launched commercially by its Kenyan affiliate Safaricom in March 2007.<sup>1</sup> To access the service, customers must first register at an authorized M-PESA retail outlet. They are then assigned an individual electronic money account linked to their phone number and accessible through an application stored on the subscriber identification module (SIM) cards of their mobile phones.<sup>2</sup> The application has two main functions. First, it allows customers to deposit

cash to and withdraw cash from their accounts by exchanging cash for electronic value at a network of retail stores. Second, it allows users to transfer funds to others, to pay bills, and to purchase mobile airtime credit. Retail stores are paid a fee by Safaricom each time they exchange cash for M-PESA credit on behalf of customers. All M-PESA transactions are authorized and recorded in real time using secure short messaging service (SMS) and are capped at \$500.

M-PESA registration is free, as is making deposits into the system. Customers are charged flat fees of approximately \$0.40<sup>3</sup> for person-to-person (P2P) transfers and bill payments, \$0.33 for withdrawals (for transactions under \$33) and \$0.013 for balance inquiries. Individual customer accounts are maintained in a server that is owned and managed by Vodafone, but Safaricom deposits the full value of its customers' balances in the system in pooled accounts in two regulated banks. Thus, while Safaricom issues and manages the M-PESA accounts, the value of the accounts is fully backed by highly liquid deposits at commercial banks. Rather than paying customers interest on the balance in their M-PESA accounts, Safaricom sets aside a small percentage of account balances in a not-for-profit trust fund. The purpose of these funds has not yet been decided.

M-PESA's function as a retail payment platform is important because it reaches a large number of people compared with other financial services outlets in Kenya (figure 20.1).<sup>4</sup> There are now nearly five times as many M-PESA outlets in Kenya as there are PostBank branches, post offices, bank branches, and automated teller machines

Figure 20.1 Outlets Offering Financial Services in Kenya



Sources: Central Bank of Kenya, Kenya Post Office Savings Bank, and Safaricom.

(ATMs) combined. M-PESA's presence in rural areas is particularly important, because access to financial services in such areas is limited, and the ability to use existing retail stores as M-PESA cash-in/cash-out outlets reduces deployment costs, provides greater convenience, and lowers the cost of access compared with other financial services outlets.

Importantly, both private and public actors were involved in creating and enabling M-PESA. The idea of M-PESA was conceived by a London-based team within Vodafone. This team believed that mobile phones could play a central role in lowering the cost of access to financial services for poor people. The idea was then developed by the Safaricom team in Kenya, which customized it and oversaw a very focused execution. The Central Bank of Kenya, in particular the Payments System Group, helped to enable the launch of M-PESA by allowing a mobile operator to take the lead in providing payment services to the general population. Following the first FinAccess survey in 2006, which showed very low levels of bank penetration in Kenya, the central bank was determined to explore all reasonable options for correcting the financial access imbalance. It worked in close partnership with Vodafone and Safaricom to assess the opportunities and risks involved prior to the launch of M-PESA. Conscious that premature regulation could stifle innovation, the Central Bank of Kenya chose to closely monitor and learn from early M-PESA trials and to formalize regulations later.

Finally, the United Kingdom's Department for International Development (DFID) played an instrumental role in the creation of M-PESA within Kenya, first by funding the organizations that made the FinAccess survey possible, and then by providing seed funding to Vodafone for early

M-PESA trials. DFID's role in spotlighting the need for mobile payments and funding the early risk demonstrates good practice for donor funding.

### A snapshot of M-PESA after three years

The speed and extent to which M-PESA has been deployed in Kenya is remarkable (figure 20.2). The number of customers hit the 9 million mark in November 2009, less than three years after the service was launched. This number of customers represents 60 percent of Safaricom's customer base, 40 percent of Kenyan adults, and 23 percent of the country's total population.<sup>5</sup>

By other measures, too, M-PESA has a deep reach in Kenya.<sup>6</sup> The number of retail stores at which M-PESA users can cash in and cash out now totals 16,900, of which nearly half are located outside urban centers. M-PESA now handles \$320 million in P2P transfers per month. On an annualized basis, this is equal to roughly 10 percent of Kenya's gross domestic product (GDP).<sup>7</sup> An average of \$650 million in cash deposit and withdrawal transactions is made at M-PESA stores every month, with an average transaction size of approximately \$33. Nearly one-fifth of Safaricom airtime purchases are now conducted through M-PESA.

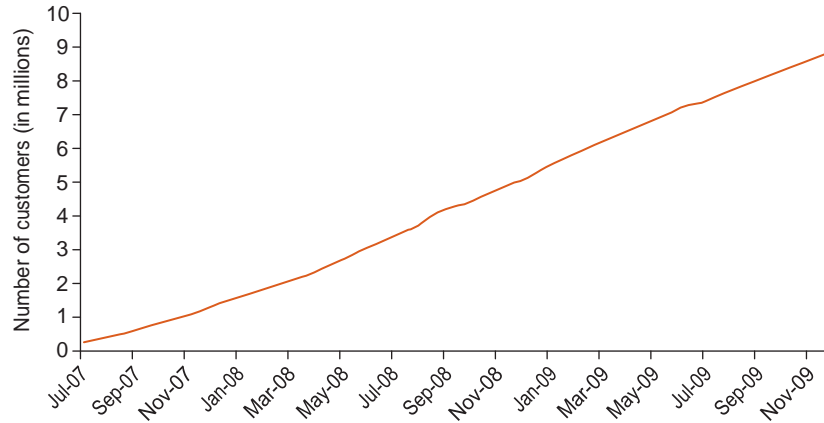
M-PESA's bill pay function, launched in March 2009, has been popular: 75 companies now use M-PESA to collect payments from their customers. The biggest user, the electric utility company, reports that roughly 20 percent of its 1 million customers now pay through M-PESA. At least two banks, Family Bank and Kenya Commercial Bank, are now using M-PESA as a mechanism for customers to either repay loans or withdraw funds from their banks accounts. And 27 companies are using M-PESA for bulk payment distribution.

### Customer perspectives on M-PESA

A survey of 3,000 M-PESA users and nonusers conducted in late 2008 shed considerable light on the profile of M-PESA's early adopters and customer usage patterns. Compared with nonusers, the average M-PESA user is twice as likely to have a bank account (72 percent versus 36 percent) and is wealthier (65 percent higher expenditure levels), more literate, and better educated (Suri and Jack 2008). Early adopters of the service also appear to be experienced with banking services and fairly savvy with technology, which probably makes them more keenly aware of the convenience of M-PESA relative to alternative financial services.

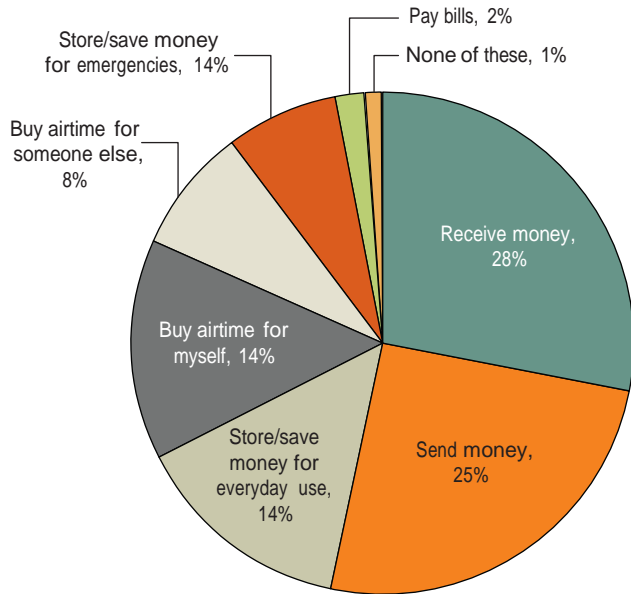
Figure 20.3 highlights the ways customers report they use M-PESA. More than half the sample use the service primarily for sending and receiving money, a use consistent with

Figure 20.2 Growth of the M-PESA Customer Base



Source: Safaricom.

Figure 20.3 How M-PESA Customers Use the Service



Source: Suri and Jack 2008.

M-PESA's broad market positioning. Though 21 percent report using M-PESA for storing money, the survey revealed that less than 1 percent of accounts had balances of more than K Sh 1,000 (\$13), and a government audit (Okoth 2009) of M-PESA in January 2009 showed that the average balance on M-PESA accounts was only \$2.70. The survey also found that 52 percent of customers use the service on only a monthly basis, suggesting that customers have yet to incorporate M-PESA into their daily lives (Suri and Jack 2008).

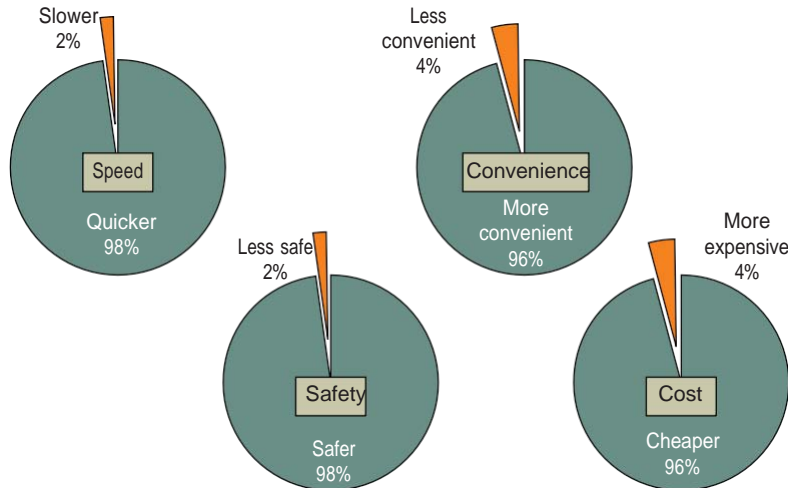
Ninety-eight percent of M-PESA users are happy with the service, according to the 2008 survey, and 84 percent claim that losing M-PESA would have a large, negative effect on them (Suri and Jack 2008). Figure 20.4 illustrates how customers compare M-PESA with alternative services. In all categories—speed, convenience, cost, and safety—customers reported better service with M-PESA than with other forms of financial services.

### M-PESA's service evolution

M-PESA's original core offering, the P2P payment, enabled customers to send money to anyone with access to a mobile phone. Importantly, it opened up a market for transactions that previously were handled largely informally—through personal trips, friends, and public transport networks (“personal networks” in figure 20.5). Although many transactions carried out under M-PESA, such as sending a portion of salary earned at the end of the month to relatives, can be characterized as scheduled payments, others allow people to draw on a much broader network of family members, friends, and business associates to access money when required. Thus, in addition to providing a large measure of convenience for transactions that were already occurring, M-PESA also provides a basic form of financial protection for a large number of users by enabling a network for instant, on-demand payments.

In recent months, Safaricom has increasingly opened up M-PESA to institutional payments, enabling companies to pay salaries and collect bill payments. In the future, Safaricom envisions increased use of M-PESA for e-commerce and in-store purchases, a strategy represented by the downward arrow in figure 20.5.

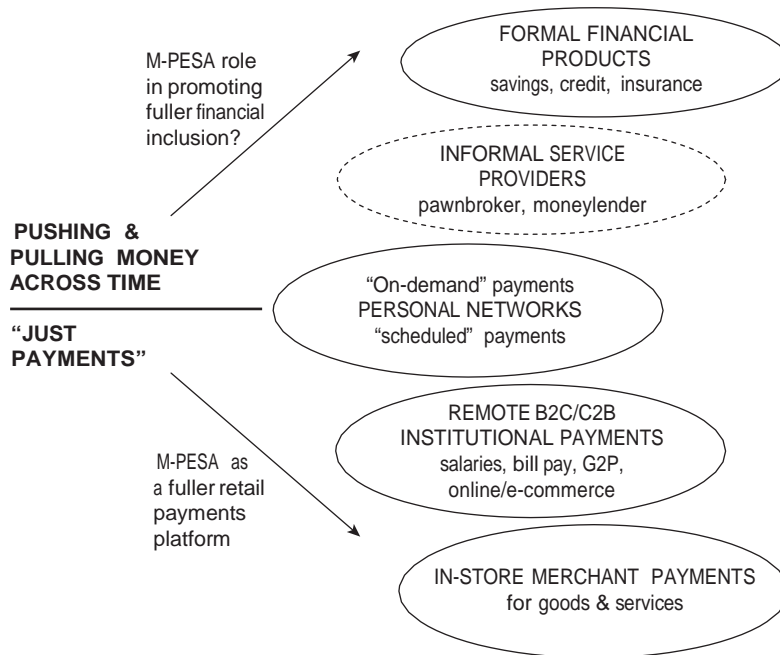
Figure 20.4 User Ratings of M-PESA Compared with Alternatives



Source: Suri and Jack 2008.

Note: At the time of the survey, alternatives consisted of 876 bank branches, 1,025 Post Office branches, 1,424 ATMs and 6,104 M-PESA agents.

Figure 20.5 Potential Range of Transactions Supported by M-PESA



Source: Bill & Melinda Gates Foundation analysis.

As represented by the upward arrow in figure 20.5, another of M-PESA's goals is to become a vehicle for delivery of a broader range of financial services for the Kenyan population. Thus far, evidence that people are willing to use the basic M-PESA account as a store of value is limited. There is likely, however, to be a need to develop more targeted savings

products that balance customers' preference for liquidity and commitment and that will connect to a broader range of financial institutions. This is the path M-PESA must take to deliver on its promise of addressing the challenge of financial inclusion in Kenya. A key precondition is regulation: the Central Bank of Kenya is in the process of finalizing

regulations that will allow nonbank outlets and platforms such as M-PESA become channels for formal deposit-taking. Beyond that, Safaricom will need to develop appropriate service, commercial, and technical models under which M-PESA can interface with the systems of other financial service providers.

### The broader lessons from M-PESA's success

In addition to the compelling marketing, cold business logic, and consistent execution behind M-PESA, the success of the service is also a vivid example of how great things can happen when public and private organizations rally around common challenges and innovative solutions. Three top-line lessons emerge from M-PESA's success. First, M-PESA shows the promise of leveraging mobile technology to extend financial services to a large number of unbanked poor people. Second, it demonstrates the importance of designing usage-based rather than float-based revenue models for financial services for poor customers. And third, M-PESA demonstrates the importance of building a low-cost transactional platform that enables customers to meet a broad range of payment needs.<sup>8</sup>

Leveraging technology to extend financial services to unbanked poor people. Mobile phone technology is quickly becoming ubiquitous, even among poor segments of the Kenyan population. Mobile penetration in Africa has increased from 3 percent in 2002 to 48 percent in 2010, and is expected to reach 72 percent by 2014, according to Wireless Intelligence. The mobile device mimics some of the key ingredients needed to offer banking services. The SIM card inside GSM phones, for example, can be used to authenticate users, thereby avoiding the high costs of distributing separate bank cards to poor customers, who typically do not generate significant profits for banks. The mobile phone can also be used as a point of sale terminal to initiate financial transactions and securely communicate with the appropriate server to request transaction authorization, thus obviating the need to deploy costly dedicated devices in retail environments.

A usage-based model for reaching poor customers with financial services. Because banks make most of their profits by collecting and reinvesting deposits, they tend to distinguish between profitable and unprofitable customers based on the likely size of their account balances and their ability to absorb credit. Banks thus find it difficult to serve poor customers because the revenue from reinvesting small-value deposits is unlikely to offset the cost of serving these customers. In contrast, mobile operators in

developing countries have developed a usage-based revenue model, selling prepaid airtime to poor customers in small increments, so that each transaction is profitable on a stand-alone basis. This is the magic behind the rapid penetration of prepaid airtime into low-income markets: a card purchased is profit booked, regardless of who buys the prepaid card. This usage-based revenue model is directly aligned with the model needed to sustainably offer small-value cash-in/cash-out transactions at retail outlets and would make possible a true mass-market approach, with no incentive for providers to deny service based on minimum balances or intensity of use.

A low-cost transactional platform that enables customers to meet a range of payment needs. Once customers are connected to an e-payment system, they can use this capability to store money in a savings account, send and receive money from friends and family, pay bills and monthly insurance premiums, receive pension or social welfare payments, or receive loan disbursements and repay them electronically. In short, when customers are connected to an e-payment system, their range of financial possibilities expands dramatically.

Putting these elements together, M-PESA has prompted a rethink on the optimal sequencing of financial inclusion strategies. Whereas most financial inclusion models have employed “credit-led” or “savings-led” approaches, the M-PESA experience suggests that there may be a third approach—focusing first on building the payment “rails” on which a broader set of financial services can ride.

### KENYA COUNTRY FACTORS: UNMET NEEDS, FAVORABLE MARKET CONDITIONS

The growth of M-PESA is a testament to Safaricom's vision and execution capacity. But Safaricom also benefited from launching the service under several enabling conditions for successful deployment of a mobile money service. These include strong latent demand for domestic remittances, poor quality of available financial services, a banking regulator that permitted Safaricom to experiment with different business models and distribution channels, a mobile communications market characterized by Safaricom's dominant market position and low commissions on airtime sales, and a reasonable amount of banking infrastructure.

### Strong latent demand for domestic remittances

Safaricom based its launch of the M-PESA service on the very brief, but powerful, phrase: “send money home.” In

this, it capitalized on the fact that demand for domestic remittance services is greater in locations where migration has occurred, separating families, particularly when the breadwinner moves to an urban center and the rest of the family remains home. This was certainly the case in Kenya, where 17 percent of households depended on remittances as their primary income source as of 2006 (FSDT 2007a).

A recent study of M-PESA suggests that latent demand for domestic remittances is related to urbanization ratios (Ratan 2008), and that the most propitious domestic remittances markets are those in which the process of rural-urban migration is sufficiently rooted to produce large migration flows but not so advanced that rural communities are hollowed out. The study also finds that countries with mid-range urbanization ratios (20 to 40 percent), especially those that are urbanizing at a rapid rate, are likely to exhibit strong rural-urban ties requiring substantial transfer of value. This is the case in many African countries, such as Kenya and Tanzania, where the share of the population living in urban areas as of 2008 was 22 percent and 26 percent, respectively, according to the World Bank. On the other hand, where urbanization ratios exceed 50 percent, such as in the Philippines and several Latin American countries, remittances are likely to be more closely linked to international rather than domestic migration patterns.

Further, the study shows that in locations where entire nuclear families move, remittances are strongest when there is cultural pressure to retain a connection with one's ancestral village. In Kenya, migrants' ties with rural homes are reinforced by an ethnic (rather than a national) concept of citizenship. These links are expressed through burial, inheritance, cross-generational, social insurance, and other ties, even in cases where migrants reside more or less permanently in cities.<sup>9</sup> In countries where migrants have a stronger connection to national as opposed to local or ethnic identity, rural to urban migration may have diminished the significance of the rural "home" and hence dampened domestic remittance flows.

### Poor quality of existing alternatives

Demand for mobile e-payments must be examined in the context of the accessibility and quality of alternative payment methods. If there are many good alternatives to mobile payments, as is typically the case in developed countries, it is difficult to convince users to switch to the new service. In the Philippines, for example, the G-Cash and Smart Money mobile payment services experienced low take-up in part because of the availability of a competitive alternative

to mobile payments—an extensive and efficient semiformal retail network of pawnshops offering domestic remittance services at commissions of 3 percent.

In Kenya, by comparison, the most common channel for sending money before M-PESA was informal bus and *matatu* (shared taxi) companies. Because these companies are not licensed to transfer money, there is considerable risk that the money will not reach its final destination. Meanwhile, Kenya Post, Kenya's major formal remittance provider, is perceived by customers as costly, slow, and prone to liquidity shortages at rural outlets. M-PESA's popularity was also bolstered by the fact that Kenya's bank branch infrastructure (currently, there are 840 branches) is far too sparse to compete with M-PESA's 16,900 cash-in/cash-out outlets. Figure 20.6 illustrates how Kenyan households sent money before and after M-PESA. Of note is the dramatic reduction in the use of informal bus systems and Kenya Post to transfer money between 2006 and 2009.

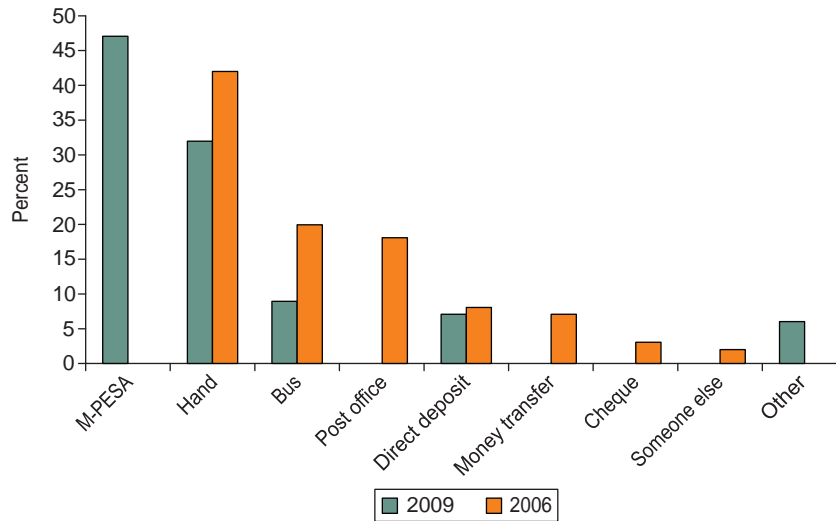
As noted, M-PESA's early adopters were primarily banked customers, suggesting that M-PESA did not acquire its initial critical mass through competition with the formal sector but rather as a complement to formal services for clients who were wealthier, more exposed to formal financial service options, and less risk averse. As M-PESA services move deeper into the Kenyan market, however, unbanked users are increasingly driving M-PESA's expansion because of the competitive advantages of mobile banking offers over other options. This is one reason why Africa, with its high proportion of unbanked people, is seen as such a promising market for mobile money applications.

### A supportive banking regulator

Regulation of mobile money can help secure trust in new mobile money schemes. At the same time, regulation may constrain the deployment of a mobile money application by limiting the scheme operator's freedom in structuring the business model, service proposition, and distribution channels. In the case of M-PESA in Kenya, Safaricom had a good working relationship with the central bank and was given regulatory space to design M-PESA in a manner that fit its market. Together, the Central Bank of Kenya and Safaricom worked out a model that provided sufficient prudential comfort to the central bank.

The Central Bank of Kenya insisted that all customer funds be deposited in a regulated financial institution and reviewed the security features of the technology platform, but it also allowed Safaricom to operate M-PESA as a payments system outside the provisions of the banking law.<sup>10</sup>

Figure 20.6 Money Transfer Behavior before and after M-PESA



Source: FSDT 2007a, 2009b.

Safaricom has paid a certain price for this arrangement. For instance, interest earned on deposited balances must go to a not-for-profit trust and cannot be appropriated by Safaricom or passed on to customers. To address anti-money-laundering concerns, there are also limits on the size of M-PESA transactions. Fundamentally, however, Safaricom was able to design the M-PESA service without having to contort its business model to fit within a prescribed regulatory model.

The Central Bank of Kenya has continued to support M-PESA's development, even in the face of pressure from banks. In late 2008, following a lobbying effort by the banking industry to shut down the service, the Central Bank of Kenya performed an audit of the M-PESA service at the request of the Ministry of Finance and declared it safe and in line with the country's objectives for financial inclusion (see Okoth 2009 for information). Thus far, the central bank appears justified in its confidence in M-PESA—there have been no reports of major fraud. Although system downtime remains frequent, it has not been catastrophic.

### A dominant mobile operator and low airtime commissions

The chances of a mobile money scheme taking root also depend on the strength of the mobile operator within its market, because a large market share is associated with a larger potential customer base for cross-selling the mobile money service, a larger network of airtime resellers that can

be converted into cash-in/cash-out agents, stronger brand recognition and trust among potential customers, and larger budgets to finance the heavy up-front investments needed to deploy a new service. With a market share of around 80 percent, Safaricom enjoyed all of these benefits when it launched M-PESA.

Successful deployment of a mobile money application also has a greater chance of success in countries where the commissions that mobile operators pay airtime resellers are relatively low. If commissions are too high, resellers will not be attracted by the incipient cash-in/cash-out business. In Safaricom's case, airtime commissions total 6 percent, of which 5 percent is passed on to the retail store. A commission of 1–2 percent on a cash-in/cash-out transaction is plausibly attractive—the store need only believe that the volume of the cash business will be five times the size of the airtime business. This seems reasonable, considering that the bulk of airtime sales are of low denominations (around \$0.25).

### A reasonable base of banking infrastructure

Finally, the ability of M-PESA stores to convert cash to e-value for customers depends on how easily they can rebalance their liquidity. If bank branch penetration is too low, rebalancing will be more difficult to achieve, because the agent channel is forced to develop alternative cash transport mechanisms. Thus, a mobile payment agent network must have at its disposal at least a minimal retail banking

infrastructure. There appears to be a branch penetration “sweet spot” for mobile money, where penetration is not so high that it hampers demand for mobile money services but not so low that agents are unable to manage their liquidity. Because of the branch networks of Equity Bank and other banks and microfinance institutions, Kenya is reasonably well supplied with rural liquidity points. Even so, shortage of cash or electronic value for M-PESA agents is a problem in both rural and urban areas in Kenya. Mobile payment operators in some other Sub-Saharan African countries face more serious liquidity constraints, especially in rural areas. Such constraints are likely to be a major factor affecting the success of mobile services in specific country contexts.

### **M-PESA'S SERVICE DESIGN: GETTING PEOPLE ONTO THE SYSTEM**

While M-PESA's rapid growth was fueled by certain country-specific enabling conditions, the success of such an innovative service hinged on the design of the service. Conducting financial transactions through a mobile phone is not an intuitive notion for many people, just as walking to a corner shop to make cash deposits and withdrawals may not at first seem natural to many. To overcome this adoption barrier, Safaricom designed M-PESA in a way that helped people immediately grasp how they might benefit from the service; removed barriers that might prevent people from experimenting with the service; and fostered trust in retail outlets that would be tasked with promoting the service, registering customers, and facilitating cash-in/cash-out services.

### **A simple message targeting a big point of concern among the population**

In very early phases of conception, Vodafone developers thought that M-PESA would be used as a way for customers to repay microloans. However, as Safaricom market-tested the mobile money proposition, they shifted the core proposition from loan repayment to helping people make P2P transfers to their friends and family. In its commercial launch, M-PESA was marketed to the public with just three powerful words: “send money home.” In an environment in which families were geographically split, this message tapped into a major concern for many Kenyans—the risks and high costs associated with sending money over long distances. Thus, a simple marketing message turned a basic “e-remittance” product into a must-have “killer” application and remains the main marketing message three

years later. Although people have proved creative in using M-PESA for their own needs, sending money home continues to be one of the most important uses, and the number of Kenyan households receiving money transfers has increased from 17 percent to 52 percent since M-PESA was introduced (FSDT 2009a).

### **A simple user interface**

The simplicity of M-PESA's message is matched by the simplicity of its user interface. The service can be launched right from the main menu of a mobile phone, making it easy for users to find. And because the service resides on the phone and does not need to be downloaded from the network each time it is used, the menu loads very quickly and prompts the user for information step-by-step. For instance, for a P2P transfer, the user is asked to enter the destination phone number, the amount of the transfer, and the personal identification number (PIN) of the sender. Once the information is gathered, it is fed back to the customer for final confirmation. Once the customer hits OK on a mobile phone, the data is sent to the M-PESA server in a single text message. Consolidating all information into a single message reduces messaging costs as well as the risk that only part of the transaction data will be sent to the server. A final advantage is that the application can use the security keys in the user's SIM card to encrypt messages end-to-end, from the user's handset to Safaricom's M-PESA server.

### **Removing adoption barriers: free to register, free to deposit, no minimum balances**

Safaricom designed M-PESA to make it as easy as possible for customers to try the service. Customer registration, which can be done at any M-PESA retail outlet, is quick, simple, and free. First, the retail clerk provides a paper registration form, where the customer enters his or her name, ID number (from Kenyan national ID, passport, military ID, diplomatic ID, or alien ID), date of birth, occupation, and mobile phone number. The clerk then checks the ID and inputs the registration information into the customer's mobile phone. SIM cards in Kenya are now preloaded with the M-PESA application. If the customer's SIM card is too old and does not contain the application, the clerk replaces it. The customer's phone number is not changed even if the SIM card is.

After Safaricom receives the application, it sends both the customer and the retail outlet an SMS confirming the transaction. The SMS provides the customer a four-digit start key



(one-time password), which they use to activate their account. Customers enter the start key and their ID number, after which they are asked to input a secret PIN of their choice. This completes the registration process. In addition to leading customers through this registration process, retail clerks explain how to use the application and discuss the costs associated with each service. This customer support early in the process is particularly important in rural areas, where a significant percentage of the potential user base is unfamiliar with the functioning of mobile phones.

The minimum M-PESA deposit amount is approximately \$1.25, but there is no minimum balance requirement. And because customers deposit money for free, there is no immediate barrier to taking up the service. M-PESA charges customers only for “doing something” with their money, such as making a transfer, withdrawing money, or buying prepaid airtime.

### **The ability to send money to anyone**

M-PESA customers can send money to any GSM mobile phone subscriber on the Safaricom, Zain, Orange, or YU networks in Kenya, regardless of whether the receiving party is an M-PESA customer. When a transfer is sent, money is debited from the sender’s account and the recipient receives a code by SMS, which is used to claim the monetary value at any M-PESA store. M-PESA is thus an account-to-cash service, with the receiver’s experience being similar to the way Western Union works today. M-PESA’s pricing, however, is quite different: customers pay a higher (roughly triple) P2P charge when sending money to a non-M-PESA customer, but at the other end the noncustomer is not charged to receive the cash, whereas registered customers pay a cash-out fee of at least \$0.30. Safaricom developed this pricing scheme with the understanding that the sender has power over the recipient, and so it chose to put pressure on the sender to require the recipient to register with M-PESA. Furthermore, Safaricom hoped that providing noncustomers with a good, no-cost first experience with M-PESA would lure them to register for M-PESA.

### **Building trust in the retail network**

Recognizing that M-PESA would not be rapidly adopted by the Kenyan population unless customers had enough trust in the M-PESA retail network that they were willing to conduct cash-in/cash-out transactions through those outlets, Safaricom employed several measures to build that trust. First, it closely linked the M-PESA brand with its own

strong corporate brand. As the mobile operator in Kenya with the dominant share of the market (more than 80 percent at M-PESA’s launch and almost as much in 2010), Safaricom was already a broadly respected and trusted brand, even among low-income customers. M-PESA retail outlets are required to paint their store “Safaricom green,” a tactic that not only gives customers confidence that the store is acting on behalf of Safaricom but also makes it easier for customers to locate cash-in/cash-out points.

Second, by investing heavily in store training and on-site supervision, Safaricom ensured that customers can have a remarkably similar experience in any retail authorized outlet they use. This “sameness” has helped to build trust in both the platform and the outlets and gives customers a consistently positive view of the service. Rather than relying on its channel intermediaries to carry out these functions in retail shops, Safaricom chose to centralize the functions through a single third-party vendor, Top Image. Quality is maintained through a rating process. A Top Image representative visits each outlet at least once per month and rates each store on a variety of criteria, including visibility of branding and the tariff poster, availability of cash and M-PESA electronic value to accommodate customer transactions, and quality of record-keeping.

Third, the fact that M-PESA customers receive instant SMS confirmation of their transaction has helped them learn by experience to trust the system. Because the receipt confirming a money transfer includes the name and number of the recipient and the amount transferred, it allows the sender to confirm instantly that the money was sent to the right person—the most common source of error. In the case of an error, the receipt can then be used to resolve the situation.

Fourth, Safaricom requires its outlets to record all cash-in/cash-out transactions in a paper-based, Safaricom-created logbook. For each transaction, the store clerk enters the M-PESA balance, the date, agent ID, transaction ID, transaction type (customer deposit or withdrawal), value, customer phone number, customer name, and the customer’s national ID number. Customers are then asked to sign the log for each transaction, which not only discourages fraud but also gives agents a way to offer first-line customer care for customers querying previous transactions. Each entry in the log is written in triplicate. The top copy is kept by the retail outlet for its own records, a second is passed on to the store’s master agent, and the third is sent to Safaricom. Because all information contained in the logbook (except for the customer signature) is captured electronically by Safaricom when the transaction is made and is available to

the master agents through a Web management system, the main purpose of the agent log is not for record-keeping but rather to provide comfort to customers who are accustomed to having transactions recorded on paper.

### Simple and transparent pricing

M-PESA pricing is transparent and predictable. There are no customer charges for the SMSs that deliver the service. Instead, fees are applied to the actual, customer-initiated transactions. All customer fees are subtracted from the customer's account, and outlets cannot charge any direct fees. Thus, outlets collect their commissions from Safaricom

(through their master agents) rather than from customers. This arrangement reduces the potential for agent abuses. Customer fees are uniform nationwide, and they are prominently posted in all outlet locations in the poster shown in figure 20.7.

M-PESA chose to specify its fees in fixed currency terms rather than as a percentage of the transaction. This makes it easier for customers to understand the precise cost of each transaction and helps them think of the fee in terms of the transaction's absolute value (for example, sending money to grandmother). It also helps them compare the transaction cost against alternative and usually costlier money-transfer arrangements (for example, the *matatu* fare plus travel time).

Figure 20.7 M-PESA Tariff Structure

Transaction type	Transaction range (KShs)		Customer charge (KShs)
	Minimum	Maximum	
<b>Value movement transactions</b>			
Deposit cash	100	35,000	0
Send money to a registered M-PESA user	100	35,000	30
Send money to a nonregistered M-PESA user	100	2,500	75
	2,501	5,000	100
	5,001	10,000	175
	10,001	20,000	350
	20,001	35,000	400
Withdraw cash by a registered M-PESA user at an M-PESA agent outlet	100	2,500	25
	2,501	5,000	45
	5,001	10,000	75
	10,001	20,000	145
	20,001	35,000	170
Withdraw cash by registered M-PESA user at PesaPoint ATM	200	2,500	30
	2,501	5,000	60
	5,001	10,000	100
	10,001	20,000	175
Withdraw cash by a non-registered M-PESA user	100	35,000	0
Buy airtime (for self or other)	20	10,000	0
<b>Pay Bill Transactions</b>			-
<b>Information transactions</b>			0–30
Show balance			1
Change secret word			0
Change PIN			20
Update menu			0
Change language			0
SIM replacement			20

Source: Safaricom.

M-PESA deposits are free to customers. Withdrawals of less than \$33 cost around \$0.33. Withdrawal charges are “banded” (that is, larger transactions incur a larger cost) so as not to discourage smaller transactions. ATM withdrawals using M-PESA are slightly more expensive than withdrawals at a retail outlet (\$0.40 versus \$0.33).

P2P transfers using M-PESA cost a flat rate of around \$0.40. These transfers are where Safaricom makes the bulk of its revenue. Thus, for a purely electronic transfer, customers pay more than double the price they pay for the average cash transaction (\$0.17), even though the cost of providing purely electronic transactions is lower than cash transactions. This model reflects a notion of optimal pricing that is based less on cost and more on customer willingness to pay. M-PESA is still cheaper, though, than the other available mechanisms for making remote payments, such as money transfer by the bus companies, Kenya Post’s Postapay, or Western Union.<sup>11</sup>

Notably, M-PESA has maintained the same pricing for transactions in its first three years of operation. This strategy has helped establish customer familiarity with the service. Safaricom has changed, however, the price of two types of customer requests that do not involve a financial transaction: balance inquiries (because the initial low price generated a burdensome volume of requests) and PIN changes (because customers are far more likely to remember their PIN if the fee to change it is higher). The volume of both types of requests decreased substantially after these price changes. As previously noted, the SMS confirmation of a transaction contains the available balance, which also helps cut down on the number of balance inquiries.

### Liquidity of last resort at bank branches and ATMs

From very early on, M-PESA signed up banks as agents, so M-PESA customers could walk into any branch of those banks to conduct cash-in/cash-out transactions. One year after its launch, M-PESA went further and partnered with PesaPoint, one of the largest ATM service providers in Kenya. The PesaPoint network includes more than 110 ATMs scattered in all eight provinces of the country. Customers can now retrieve money from any PesaPoint ATM. To do so, they select “ATM withdrawal” from the M-PESA menu on their mobile phone, after which they receive a one-time ATM authorization code. They then enter that code on the ATM keyboard to make the withdrawal. No bank card is needed for the transaction.

M-PESA’s liquidity system is not without its challenges, however. Because of cash flow constraints, M-PESA retail outlets cannot always meet requests for withdrawals, especially large ones. Furthermore, the agent commission structure discourages outlets from handling large transactions. As a result, customers are sometimes forced to spread large withdrawals over several days rather than withdraw a lump sum, at an added cost and inconvenience. Cash flow constraints also undermine customer trust in M-PESA as a mechanism for high-balance, long-term saving. Use of bank branches and ATMs to give customers a sort of liquidity mechanism of last resort has bolstered the credibility of the M-PESA system, however,

### M-PESA’S EXECUTION STRATEGY: QUICKLY REACHING CRITICAL MASS

Although strong services design has been a major factor in the success of M-PESA, an appropriate execution strategy has also been a key factor. Importantly, Safaricom recognized that it would be difficult to scale M-PESA incrementally, because it had to overcome three significant obstacles common to any new electronic payment system, namely, adverse network effects, the chicken-and-egg trap, and trust. First, in regard to adverse network effects, the value to the customer of a payment system depends on the number of people connected to and actively using it. The more people on the network, the more useful it becomes.<sup>12</sup> While network effects can help a scheme gain momentum once it reaches a critical mass of customers, they also make it difficult to attract early adopters of the new technology. Second, to grow, M-PESA had to attract customers and stores in tandem. It is difficult, however, to attract customers when there are few stores to serve them, and equally hard to convince stores to sell the service when there are few customers to be had (thus, the chicken-and-egg trap). Thus, M-PESA needed to drive both customer and store acquisition aggressively. Third, a company will be successful in attracting customers only when prospective customers have confidence in the reliability of the new system. In the case of M-PESA, customers had to be comfortable with three elements that were new at the time in Kenya: a payment system operated by a mobile operator, using a nonbank retail outlet to meet cash-in/cash-out needs, and using mobile phones to access account information and initiate transactions.

In the early stages of development of a payments system, the three problems described above reinforce each other, creating a significant hurdle to growth. In many cases, this

hurdle helps explain why many other mobile money deployments remain subscale. M-PESA, however, overcame this hurdle through very forceful execution on two key fronts: Safaricom made significant up-front investments in building a strong service brand for M-PESA, and it effectively leveraged its extensive network of airtime resellers to build a reliable, consistent retail network that served customers' liquidity needs.

### **Aggressive up-front investment in promoting the M-PESA brand**

From the beginning, Safaricom sought to foster customer trust in M-PESA and relied on existing customers to be the prime mechanism for drawing in new customers. The task was all the more difficult because Safaricom was not only introducing a new product, but an entirely new product category, to a market that had little experience with formal financial services. Safaricom's initial target for M-PESA was about 1 million customers within one year of the launch of the service, equal to 17 percent of Safaricom's customer base of about 6 million customers at the time, according to Safaricom company results for the year ending March 2007.

**National launch at scale.** After small pilots involving less than 500 customers,<sup>13</sup> M-PESA launched nationwide, increasing the likelihood that the service could reach a critical mass of customers in a short time frame. At launch, Safaricom had 750 stores that covered all of Kenya's 69 district headquarters. The launch was a massive logistical challenge that led to a great deal of customer and store confusion and, during the first few months, delays of several days in reaching customer service hotlines. User and store errors were frequent since everyone was new to the service. But the gamble paid off. Logistical problems subsided after a few months, leaving strong brand recognition and top-of-mind awareness among large segments of the population. The service outran first-year growth targets, quickly turning network effects in its favor as new customers begat more customers and turned M-PESA into a compelling business proposition for more stores.

**An appropriate marketing mix.** Initial M-PESA marketing featured and targeted urban, relatively wealthy city dwellers with a need to "send money home." The choice of this demographic as the initial customer created an aspirational image for prospective customers and avoided giving the impression that M-PESA was a low-value product

aimed at the poor. Over time, the marketing moved from young, up-market urban dwellers with desk jobs to more ordinary Kenyans with lower-paid professions.

M-PESA's launch was associated with significant up-front investment in television and radio marketing,<sup>14</sup> but there was also intense outreach through road shows, in which company agents traveled around the country signing people up, explaining the product, and demonstrating how to use it. Over time, as people became more familiar with M-PESA, it was no longer necessary to do this kind of hands-on outreach. Television and radio marketing was largely replaced by the omnipresent M-PESA branding at all outlets, supported by a few large billboards. Newer ads feature a general emotional appeal, with a wider range of services indicated.

### **A scalable distribution channel**

From the time Safaricom launched M-PESA, it understood that the primary role of the mobile phone is to enable the creation of a retail outlet-based channel for cash-to-digital value conversion. It also understood that for this cash-to-digital conversion to be broadly available to the bulk of the population, Safaricom had to develop a channel structure that could support thousands of M-PESA stores spread across a broad geographical area. To achieve this, Safaricom built four elements into its channel management execution strategy: engaging intermediaries to help manage the individual stores, thereby reducing the number of direct contacts it had to deal with, ensuring that outlets received sufficient incentives to actively promote the service, maintaining tight control over the customer experience, and developing several different methods for stores to rebalance their stocks of cash and e-value.

**Two-tier channel management structure.** Safaricom created a two-tier structure with individual stores (sub-agents, in Safaricom's parlance) that depends on master agents (referred to by Safaricom as agent head offices). Agent head offices maintain all contact with Safaricom, and perform two key functions: liquidity management (buying and selling M-PESA balance from Safaricom and making it available to individual stores under their responsibility), and distribution of agent commissions (collecting the commission from Safaricom based on the overall performance of the stores under them and remunerating each store). Individual stores are either directly owned by an agent head office or working for one under contract.

Giving stores incentives. Retail outlets will not maintain sufficient stocks of cash and electronic money unless they are adequately compensated for doing so. Hence, Safaricom pays commissions to agent head offices for each cash-in/cash-out transaction conducted by stores under their responsibility. Although Safaricom does not prescribe the commission split between agent head offices and stores, most agent head offices pass on 70 percent of commissions to the store.<sup>15</sup> For deposits under \$33, Safaricom pays a \$0.133 commission, of which \$0.074 goes to the store after tax. For withdrawals, Safaricom pays \$0.200, of which \$0.111 goes to the store. So, assuming equal volumes of deposits and withdrawals, the store earns \$0.092 per transaction. Assuming the store conducts 60 transactions per day, it earns around \$5.50—almost twice the prevailing daily wage for a clerk in Kenya.

Recall that Safaricom charges customers \$0.333 on a round-trip savings transaction (free deposit plus \$0.33 for the withdrawal), which is in fact equal to what the channel receives (\$0.13 on the deposit plus \$0.20 for the withdrawal). So, assuming equal volumes of deposits and withdrawals, Safaricom does not make money on cash transactions. It merely “advances” commissions to the channel when customers make deposits and recoups them when customers withdraw. As noted, Safaricom generates the bulk of its revenue from services for which customer willingness to pay is the highest—electronic, P2P transactions.

Because store revenues are dependent on the number of transactions they facilitate, Safaricom has been careful not to flood the market with too many outlets, lest it depress the number of customers per agent. Instead, it has maintained balanced growth in the number of outlets relative to the number of active customers, resulting in an incentivized and committed agent base.

**Maintaining tight control over the customer experience.** Safaricom also recognized early on that customers need to have a good experience at the retail stores offering M-PESA services, where the bulk of transactions take place. To ensure that it maintained control over the customer experience, it has not relied on agent head offices to perform all channel management functions. Instead, it concentrated the evaluation, training, and on-site supervision of stores in a single outsourcing partner, Top Image. The more routine and non-customer-facing store support activities, such as liquidity management and distribution of store commissions, are left to a large pool of agent head offices. Through its contract with Top Image, however, Safaricom retained direct, centralized control over key

elements of the customer experience: store selection, training, and supervision.

**Developing multiple store liquidity management methods.** By far the biggest challenge faced by M-PESA stores is maintaining enough liquidity, in terms of both cash and e-float,<sup>16</sup> to be able to meet customer requests. If they take too many cash deposits, stores will find themselves running out of e-float with which to facilitate further deposits. If they do too many withdrawals, on the other hand, they will accumulate e-float but will run out of cash. Thus, stores frequently undertake liquidity management efforts.

The M-PESA channel management structure was conceived to offer stores three methods for managing liquidity. Two of these place the agent head office in a central role, with the expectation that it will “recycle” e-float between locations experiencing net cash withdrawals (that is, accumulating e-float) and locations with net cash deposits (that is, accumulating cash). In the first method, the agent head office provides direct cash support to stores. The store clerk comes to the agent head office to deliver or offload cash, or the agent head office sends cash runners to the store to perform these functions.

In the second method, the agent head office and stores use their respective bank accounts. If the store has excess cash and wants to buy M-PESA e-float from the agent head office, the store deposits the cash into the account of the agent head office at the nearest bank branch or ATM. Once the agent head office confirms receipt of the funds into its account, it transfers M-PESA e-float to the store’s M-PESA account. If the store wants to sell e-float to obtain cash, the store transfers M-PESA e-float to the agent head office. The agent head office then deposits (or transfers) money into the store’s bank account, after which the store can withdraw the cash at the nearest branch or ATM.

In the third method, stores interact directly with a bank that has registered as an M-PESA “superagent.” Under this method, the agent head office does not get involved in liquidity management. Instead, stores open an account with a participating superagent bank. To rebalance their cash, stores deposit and withdraw cash against their bank account at the nearest branch or ATM of the bank. The store then electronically buys and sells e-float in real time against its bank account. From a store’s perspective, one drawback of using a bank-based superagent mechanism is that it can only be used during banking business hours.

In all cases, the e-float–cash nexus will remain the key constraint to further development of M-PESA, because it

requires the physical movement of cash around the country and is thus the least scalable part of the system.

## M-PESA'S FUTURE EVOLUTION

The experience of M-PESA demonstrates how powerful a payment network that offers convenience at an affordable cost can be once a critical mass of customers is reached. It also shows that achieving critical mass requires a service design that removes as many adoption barriers as possible, together with significant investment in marketing, branding, and agent network management. The Kenyan experience also suggests that several country-level factors must be aligned to set the scene for successful mobile money development, including the labor market profile (demand for remittances generated by rural-urban migration), the quality of available financial services, support from the banking regulator, and the structure of the mobile communications market (dominant mobile operator and low airtime commissions).

While M-PESA has been more successful than anyone could have imagined at its launch, the model still has substantial room for development. A threefold wish list for M-PESA could be delineated as follows: further mainstreaming of M-PESA's regulatory treatment, pricing that opens up a much larger market of microtransactions, and expanding M-PESA so that customers have access to a broader range of financial services.

### Mainstreaming M-PESA's regulatory treatment

M-PESA's regulatory treatment as a payments vehicle needs to be formalized so that it can become regulated in the most appropriate way. To this end, the Central Bank of Kenya is backing a new payments law that would cover M-PESA transactions (as of this writing, the draft had not yet been approved by the Kenyan parliament). The Central Bank of Kenya is also in the process of finalizing agent banking regulations that would allow commercial banks to use retail outlets as a delivery channel for financial services. Banks are quite reasonably complaining that they could not replicate the M-PESA service themselves because they are not currently allowed to undertake customer transactions through agent networks on their own. Allowing both banks and M-PESA to operate such agent networks would level the playing field.

### Pricing that enables smaller payments

M-PESA's current pricing model is not conducive to small transactions. The fee for a \$10 P2P transfer plus withdrawal,

for example, is approximately 7 percent of the amount of the transaction (\$0.40 for the transfer plus \$0.33 for the withdrawal). Adjusting M-PESA's current pricing model to account for smaller-denomination transactions would have two advantages. First, it would make the service more accessible to the poor, for whom pricing is now too high given their transactional needs. Such a reduction would allow Safaricom to maintain customer growth once saturation starts to set in at current pricing. Second, a pricing adjustment would allow customers to use M-PESA for their daily transaction needs, and in particular to save on a daily basis, which would be beneficial to those who are paid daily.

A reduction in customer prices could come about in several ways. There is room for "tranching" the P2P fee of \$0.40, for example, so that the price of smaller, or more frequent, transactions becomes more affordable. For cash transactions, one way to enable lower fees would be to establish street-level M-PESA subagents who would offer lower costs and commissions than store-based agents. Subagents would be a kind of "e-susu collector," operating with small working capital in order to aggregate small customer transactions. Subagents would use normal M-PESA retail outlets to rebalance their cash and M-PESA stored value. The key principle here is that segmentation of customers would go hand-in-hand with segmentation of agents.

### Linking with banks and other institutions

While some customers use M-PESA as a saving device, the service still falls short of being a useful method of saving for most poor people. The fact that the average balance of M-PESA accounts was less than \$3 in early 2009 is partly a "large number" problem: if 900,000 people used M-PESA to save, that means 10 percent of users use the service to save, and that the average savings balance is diluted because it takes into account all M-PESA users rather than only users who save. But the fundamental problem is that there is still a lot of conversion of electronic value back into cash. This can be attributed to a combination of factors:

- *Lack of marketing.* Safaricom does not want to publicly promote using M-PESA as a saving tool for fear of provoking the Central Bank Kenya to regulate it more tightly.
- *Customer pricing.* The flat fee of around \$0.33 for withdrawals under \$33 means that small withdrawals carry a large relative fee.
- *Product design.* M-PESA works very much like an electronic checking account and does not offer structured

saving products that may help people build discipline around savings.

- *Inflation.* M-PESA does not pay interest. In an environment with 15 percent inflation (during its first full year of operation in 2008), saving may be too onerous for much of the Kenyan population.
- *Trust.* M-PESA deposits are not supervised by the Central Bank of Kenya. And unlike payments, where trust can be validated experientially in real time, saving requires garnering the trust of customers over a longer period of time.
- *Privacy.* People may want more privacy for their saving behavior than an agent provides.
- *Excess liquidity.* The 16,000 M-PESA cash-in points in Kenya are also 16,000 cash-out points. The ubiquity of M-PESA agents may make it too easy for customers to cash out their funds, thus limiting their ability to accumulate large balances.

Rather than expecting Safaricom to develop and market more comprehensive savings services, M-PESA should support saving by linking to banks. M-PESA could then become a massive transaction acquisition network for banks rather than an alternative to them. That said, Safaricom is beginning to connect with banks. In September 2009, for example, Family Bank and M-PESA established a connection allowing customers to transfer money from M-PESA to their Family Bank account using M-PESA's bill pay function. This connection follows a successful pilot of loan repayments via M-PESA's bill pay function.

M-PESA would also benefit from establishing further links with institutions beyond banks, such as billers, distributors, and employers. By promoting M-PESA as a mechanism for distributing salaries and social welfare payments, enabling payments across supply chains, and paying bills, the need for cash-in and cash-out services would be minimized, and, as a result, a key component of transaction costs could be reduced. Savings balances may also be higher if people received payments directly into their accounts rather than in cash, and if they had other useful things to do with their money in electronic form.

### **CONCLUDING THOUGHTS: HOW M-PESA CAN REINVIGORATE FINANCIAL INCLUSION EFFORTS**

Imagine a world where there are no banks where you live. The nearest branch is 10 kilometers away, and it takes you almost an hour to get there by foot and bus. With waiting

times at the branch, a trip to the bank and back may take two hours—approximately a quarter of your working day. A bus fare of only \$0.50 to get to the bank may well represent one-quarter of your income on a good day. With the bank fees included, each banking transaction costs you the equivalent of almost half a day's wages. It would be like charging someone with an average income in the United States something like \$50 for each ATM transaction. Then, imagine a world without credit instruments or electronic payments. No checks, no credit cards, no money orders, no direct debits, no Internet banking. All your transactions are done in cash or, worse, by bartering goods. All exchanges are physical, person-to-person, hand-to-hand. Consider the hassle and the risk of sending money to distant relatives, business partners, or banks.

How would you operate in such a world? A recent book, *Portfolios of the Poor*, documents how poor people cope (Collins et al. 2009). Some people save to “push” excess money from today to tomorrow, some people borrow to “pull” tomorrow's money to fund necessary expenses today. They store cash in the home to meet daily needs, they leave it with a trusted friend for emergencies, they buy jewelry because that represents a future for their children, they pile up bricks for the day when they can build an extra room in their house. They make contributions to a savings group with a circle of friends to build up a pot of money, and one day it will be their turn to take that pot home to buy new clothes. They borrow from friends, seek advances from their employers, pawn their jewelry, and borrow from a high-interest moneylender.

Lack of good financial options is undoubtedly one of the reasons why poor people are trapped in poverty. In many cases, poor people cannot sustain themselves or aspire to earn higher incomes because they are not able to invest in better farming tools and seeds to enhance their productivity, start a microenterprise, or even take the time to search for better-paying employment opportunities. Their income is volatile, often fluctuating daily, and without reliable ways of pushing and pulling money between good days and bad days, they face stark choices such as pulling their children out of school or putting less food on the table during bad patches. Without good financial tools, they also may not be able to cope with shocks that periodically set them back. Most of these shocks are foreseeable, if not entirely predictable: a drought, ill health, and lifecycle events such as marriage and death.

Cash is the main barrier to financial inclusion. As long as poor people are able to exchange value only in cash—or worse, physical goods—they will remain too costly for

formal financial institutions to address in significant numbers. Few banks are willing to build the costly infrastructure necessary for collecting low-value cash deposits and redeeming savings back into small sums of cash in low-income or rural areas. But once poor people have access to cost-effective electronic means of payments such as M-PESA, they could, in principle, become profitable to financial institutions. Although M-PESA itself does not constitute financial inclusion, it does provide a glimpse of a commercially sound, affordable, and effective way to offer financial services to all.

## NOTES

1. See Hughes and Lonie (2009) for a historical account of the M-PESA service, Mas and Morawczynski (2009) for a fuller description of the service, and Mas and Ng'weno (2009) for the latest accomplishments of M-PESA.
2. A SIM card is a smart card found inside mobile phones that are based on the Global System for Mobile communications (GSM) family of protocols. The SIM card contains encryption keys, secures the user's persona identification number on entry, and drives the phone's menu. SMS is a data messaging channel available on GSM phones.
3. These amounts use an exchange rate of \$1 to 75 Kenyan shillings.
4. Kenya has a population of nearly 40 million. GDP per capita is \$1,600, 78 percent of people live in rural areas, and 19 percent of adults have access to a formal bank account. See FSDT (Financial Sector Deepening Trust) (2009a) for financial access data derived from the FinAccess survey, a nationally representative survey of 6,600 households conducted in early 2009.
5. The 2009 FinAccess survey (FSDT 2009a, p. 16) confirms that 40 percent of adults have used M-PESA.
6. See Safaricom (2009) for key monthly M-PESA statistics. Additional figures are taken from Safaricom's published half-year results for the period ending September 2009 and Central Bank of Kenya reports.
7. Although the number of P2P transactions per customer has been rising steadily, it remains quite low, probably still less than two transactions per month.
8. For more detailed accounts of the M-PESA story, see Heyer and Mas (2009) on the country factors that led to M-PESA's success, Mas and Morawczynski (2009) on M-PESA's service features, Mas and Ng'weno (2010) on Safaricom's execution, and Mas (2009) on the economics underpinning branchless banking systems.
9. For a fuller analysis of the use of mobile money for domestic remittances in Kenya, see Ratan (2008) and Morawczynski (2008).

10. Although the Central Bank of Kenya Act was amended in 2003 to give the central bank broad oversight of payment systems, the operational modalities for this oversight have not been implemented; they are pending approval of a new National Payments System Bill that has languished in parliament.

11. Morawczynski and Pickens (2009) find that sending K Sh 1,000 through M-PESA is 27 percent cheaper than the post office's PostaPay and 68 percent cheaper than sending it by a bus company.

12. Network effects are commonly illustrated with reference to fax machines: the first set of people who bought a fax machine did not find them very useful, because they were not able to send faxes to many people. But as more people bought fax machines, everyone's faxes became increasingly useful. Network effects are sometimes called demand-side economies of scale to emphasize that scale affects the *value* of the service to each customer. This distinguishes it from supply-side economies of scale, which refer to situations in which the average *cost* per customer fall as volume increases. Davidson (2009) discusses implications of network effects for mobile money.

13. Safaricom's earliest pilot project conducted in 2004–05 revolved around microloan repayments and involved the Commercial Bank of Africa, Vodafone, Faulu Kenya, and MicroSave.

14. In a survey of 1,210 users in late 2008, 70 percent of respondents claimed they first heard about M-PESA from television or radio advertisements (FSDT 2009b).

15. Safaricom would like the split to be 20 percent/80 percent, meaning that more of the commission is passed on to the retail outlet.

16. E-float is the balance of money that an agent has in his M-PESA account, which he can electronically transfer to customers in exchange for cash.

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